Lesson 2

Objective: Relate multiplication to the array model.

Suggested Lesson Structure

■ Fluency Practice   (15 minutes)
■ Application Problem   (5 minutes)
■ Concept Development   (30 minutes)
■ Student Debrief   (10 minutes)
   Total Time   **(60 minutes)**
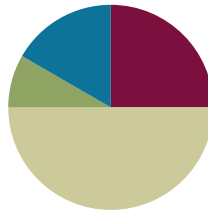
Fluency Practice (15 minutes)

▪ Add and Subtract by 2 **3.OA.1**   (8 minutes)
▪ Group Counting **3.OA.1**   (4 minutes)
▪ Add Equal Groups **3.OA.1**   (3 minutes)

Sprint: Add and Subtract by 2 (8 minutes)

Materials: (S) Add and Subtract by 2 Sprint

Note: This sprint supports group counting skills that are foundational to interpreting multiplication as repeated addition.

Directions for Administration of Sprints

One sprint has two parts with closely related problems on each. Each part is organized into 4 quadrants that move from simple to complex. This builds a challenge into each sprint for every learner. Before the lesson, cut the sprint sheet in half to create *Sprint A* and *Sprint B.* Students complete the two parts of the sprint in quick succession with the goal of improving on the second part, even if only by one more. With practice the following routine takes about 8 minutes.

Sprint A

(Put Sprint A face down on desks with instructions to not look at problems until signal is given.)

   T: You will have 60 seconds to do as many problems as you can.

   T: I do not expect you to finish all of them. Just do as many as you can, your personal best.

   T: Take your mark! Get set! THINK! (When you say THINK, students turn papers over and work furiously to finish as many problems as they can in 60 seconds. Time precisely.)

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(After 60 seconds.)

   T: Stop! Circle the last problem you did. I will read just the answers. If you got it right, call out "Yes!" and give a fist pump. If you made a mistake, circle it. Ready?

(Repeat to the end of Sprint A, or until no one has any more correct.)

   T: Now write your number correct at the top of the page. This is your personal goal for Sprint B.

   T: How many of you got 1 right? (All hands should go up.)

   T: Keep your hand up until I say a number that is 1 more than the number you got right. So, if you got 14 right, when I say 15 your hand goes down. Ready?

   T: (Quickly.) How many got 2 right? 3? 4? 5? (Continue until all hands are down.)

 (Optional routine, depending on whether or not your class needs more practice with Sprint A.)

   T: Take one minute to do more problems on this half of the sprint.

(As students work you might have the person who scored highest on Sprint A pass out Sprint B.)

   T: Stop! I will read just answers. If you got it right, call out "Yes!" and give a fist pump. If you made a mistake, circle it. Ready?

(Read the answers to the first half again as students stand.)

Movement: To keep the energy and fun going, do a stretch or a movement game in between Sprints.

Sprint B

(Put Sprint B face down on desks with instructions to not look at the problems until the signal is given. Repeat the procedure for Sprint A up through the show of hands for how many right.)

   T: Stand up if you got more correct on the second Sprint than on the first.

   S: (Students stand.)

   T: Keep standing until I say the number that tells how many more you got right on Sprint B. If you got 3 more right on Sprint B than on Sprint A, when I say 3 you sit down. Ready?

(Call out numbers starting with 1. Students sit as the number by which they improved is called.) Students may take sprints home.

Group Counting (4 minutes)

Note: Basic skip-counting skills from Grade 2 shift focus in this Grade 3 activity. Group-counting lays a foundation for interpreting multiplication as repeated addition. When students count groups in this activity, they add and subtract groups of three when counting up and down.

   T: Let's count to 18 forward and backward. I want you to whisper, whisper, and then speak numbers.

   T: Watch my fingers to know whether to count up or down. A closed hand means stop. (Show signals as you explain.)

   T: (Rhythmically point up until a change is desired. Show a closed hand then point down.)

   S: (Whisper 1, whisper 2, speak 3, etc.)

   T: Let's count to 18 forward and backward again. This time, think every number instead of whispering.

S: (Think), (think), 3, (think), (think), 6, (think), (think), 9, etc.

T: What did we just count by? Turn and talk to your partner.

S: Threes.

T: Let's count by threes. (Direct students to count forward and backward to 18, periodically changing directions. Emphasize the 9 to 12 transition.)

Add Equal Groups (3 minutes)

Materials: (S) Personal white boards

Note: This activity reviews Lesson 1. Students directly relate repeated addition to multiplication. They interpret products as the number of equal groups times the number of objects in each group.

T: (Project a picture array with 3 groups of 2 circled.) How many groups are circled?

S: 3.

T: How many are in each group?

S: 2.

T: Write this as an addition sentence.

S: (Write 2 + 2 + 2 = 6.)

T: Write a multiplication sentence for 3 twos equals 6.

S: (Write 3 × 2 = 6.)

Continue with possible sequence: 3 groups of 5, 5 groups of 10, and 3 groups of 4.

Application Problem (5 minutes)

Jordan uses 3 lemons to make 1 pitcher of lemonade. He makes 4 pitchers. How many lemons does he use altogether? Use the RDW process to show your solution.

Note: This problem reviews equal groups multiplication from Lesson 1. It also leads into today's concept development of relating multiplication to the array model.

$4 \times 3 = 12$
Jordan uses 12 lemons altogether.

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Concept Development (30 minutes)

Materials: (S) Personal white boards, Threes Array Template inside personal boards (pictured below), lemons
image from application problem, 1 sheet of blank paper per student

Problem 1: Relate equal groups to arrays.

T: Look back at Jordan's lemons. Compare the way his lemons are organized with the groups of 3 circles on your template.

S: The lemons in one group are touching each other, but the circles have space between them. → Each line on the template shows three, like each group of lemons. → The template is organized with everything in straight lines.

T: Many students are noticing straight lines on the template.   Let's call a straight line going across a **row**. Use your blank paper to cover all but the top row.

S: (Cover all but the top row.)

T: Uncover 1 row at a time in the picture. As you uncover each row, write the new total number of circles to the right of it.

S: (Skip-count by three using the Threes Array Template.)

T: At the signal say the total number of circles you counted. (Signal.)

S: 30 circles!

T: Take 10 seconds to find how many rows of 3 you counted. At the signal say how many. (Signal.)

S: 10 rows!

T: True or false: 10 rows of 3 circles equals 30 circles?

S: True!

T: (Write 10 × 3 = 30 on the board.) Use the picture on your template to talk with your partner about why this equation is true.

S: Yesterday we learned that we can multiply equal groups. → We skip-counted 10 rows of 3 circles each and the total is 30. → It just means 10 groups of 3 and when you add 10 threes, you get 30! → Yeah, but writing 10 × 3 is a lot easier than writing out 3 + 3 + 3 + 3 …

T: We call this type of organized picture an **array**.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

As you teach the vocabulary rows, have students trace a row on the array with a finger while saying the word. You may also have them identify other rows around the room. For example, students may be seated in rows or you may have books arranged in rows.
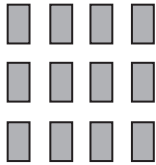
Threes Array Template (with student work)
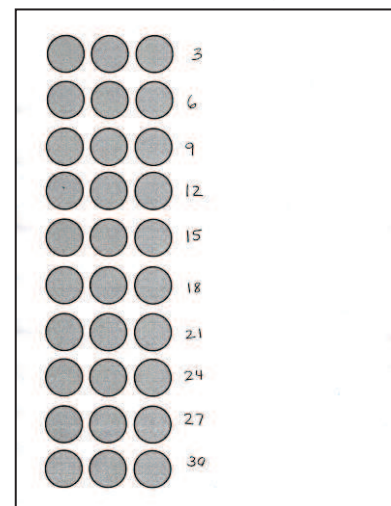
NOTES ON MULTIPLE MEANS OF REPRESENTATION:

As you teach the vocabulary *array*, you may want to ask students to turn and talk, describing or defining an array for their partner.

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T: (Project or draw the following image.) Take a look at this array.

T: At the signal tell how many rectangles are in the top row. (Signal.)

S: 4 rectangles.

T: The size of 1 row is 4 rectangles.

T: At the signal tell how many groups of four are in the array. (Signal.)

S: 3 groups of four.

T: To write the multiplication **fact**, we first write the **number of groups**. How many groups?

S: 3 groups!

T: (Write 3 × _____.) Next we write the **size of the group**. How many rectangles are in each group?

S: 4 rectangles!

T: (Fill in the fact to read 3 × 4.) Skip-count to find the total number of rectangles in the array.

S: 4, 8, 12!

T: (Complete the equation to read 3 × 4 = 12.) We just found the answer to the multiplication fact that represents the array.

Show an array of 2 rows of 6 and repeat the process.

Problem 2: Redraw equal groups as arrays.

T: (Project or draw the following image.) The drawing shows 3 equal groups of 5.
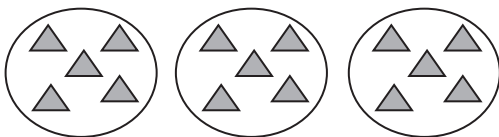
T: Re-draw the picture as an array with 3 rows of 5 on your personal board.

S: (Draw a 3 by 5 array.)

T: Write a multiplication fact to describe your array.

S: (Write 3 × 5.)

T: Skip-count to find the answer to the multiplication fact.

S: 5, 10, 15. (Write 3 × 5 = 15.)

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Provide a challenge in this part of the lesson by giving a multiplication sentence (e.g., 5 x 4 = _____) and no picture. Have students draw both the equal groups and array to represent the sentence. Then they skip-count to find the total.

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Show 6 groups of 2 and repeat the process.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Relate multiplication to the array model.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson. You may choose to use any combination of the ideas below to lead the discussion.

- In Problems 5 and 6 how do the arrays represent equal groups?
- Compare equal groups in scattered configurations and arrays.
- Review the vocabulary: **row**, **array**, **fact**, **number of groups**, **size of groups**.
- Prompt students to notice arrays around the room and possibly think of arrays in real world situations.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

A

Correct _____

Add or subtract.

1	0 + 2 =		23	2 + 4 =	
2	2 + 2 =		24	2 + 6 =	
3	4 + 2 =		25	2 + 8 =	
4	6 + 2 =		26	2 + 10 =	
5	8 + 2 =		27	2 + 12 =	
6	10 + 2 =		28	2 + 14 =	
7	12 + 2 =		29	2 + 16 =	
8	14 + 2 =		30	2 + 18 =	
9	16 + 2 =		31	0 + 22 =	
10	18 + 2 =		32	22 + 22 =	
11	20 - 2 =		33	44 + 22 =	
12	18 - 2 =		34	66 + 22 =	
13	16 - 2 =		35	88 - 22 =	
14	14 - 2 =		36	66 - 22 =	
15	12 - 2 =		37	44 - 22 =	
16	10 - 2 =		38	22 - 22 =	
17	8 - 2 =		39	22 + 0 =	
18	6 - 2 =		40	22 + 22 =	
19	4 - 2 =		41	22 + 44 =	
20	2 - 2 =		42	66 + 22 =	
21	2 + 0 =		43	888 - 222 =	
22	2 + 2 =		44	666 - 222 =	

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B

Improvement _____   # Correct _____

Add or subtract.
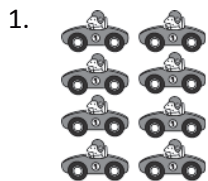
1	2 + 0 =		23	4 + 2 =	
2	2 + 2 =		24	6 + 2 =	
3	2 + 4 =		25	8 + 2 =	
4	2 + 6 =		26	10 + 2 =	
5	2 + 8 =		27	12 + 2 =	
6	2 + 10 =		28	14 + 2 =	
7	2 + 12 =		29	16 + 2 =	
8	2 + 14 =		30	18 + 2 =	
9	2 + 16 =		31	0 + 22 =	
10	2 + 18 =		32	22 + 22 =	
11	20 - 2 =		33	22 + 44 =	
12	18 - 2 =		34	66 + 22 =	
13	16 - 2 =		35	88 - 22 =	
14	14 - 2 =		36	66 - 22 =	
15	12 - 2 =		37	44 - 22 =	
16	10 - 2 =		38	22 - 22 =	
17	8 - 2 =		39	22 + 0 =	
18	6 - 2 =		40	22 + 22 =	
19	4 - 2 =		41	22 + 44 =	
20	2 - 2 =		42	66 + 22 =	
21	0 + 2 =		43	666 - 222 =	
22	2 + 2 =		44	888 - 222 =	

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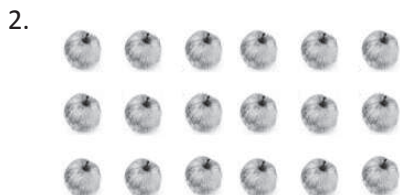Name _____   Date _____
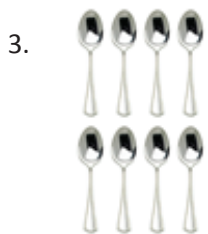
Use the arrays below to answer each set of questions.

1.

a. How many rows of cars are there? _____
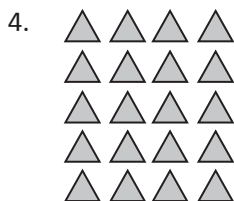
b. How many cars are there in each row? _____

2.

a. What is the number of rows? _____

b. What is the number of objects in each row? _____

3.

a. There are 4 spoons in each row. How many spoons are in 2 rows? _____

b. Write a multiplication fact to describe the array. _____

4.

a. There are 5 rows of triangles. How many triangles are in each row? _____

b. Write a multiplication fact to describe the total number of triangles. _____

5. The dots below show 2 groups of 5.

a. Redraw the circles as an array that shows 2 rows of 5.

b. Compare the drawing to your array. Write at least 1 reason why they are the same and 1 reason why they are different.

6. Emma collects rocks. She arranges them in 4 rows of 3. Draw Emma's array to show how many rocks she has altogether. Then write a multiplication sentence to describe the array.

7. Joshua helps his father organize cans of food in the cupboard. He makes an array with the cans and thinks, "My cans show 5 × 3!" Make a drawing that shows how many cans are in Joshua's array.

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Name _____   Date _____

1.   ☆ ☆ ☆
     ☆ ☆ ☆   a. There are 4 rows of stars. How many stars are in each row? _____
     ☆ ☆ ☆
     ☆ ☆ ☆   b. Write a multiplication fact to describe the total number of stars. _____

2.   Judy collects seashells. She arranges them in 3 rows of 6. Draw Judy's array to show how many seashells she has all together. Then write a multiplication sentence to describe the array.

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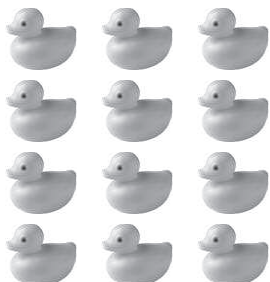Name _____ Date _____

Use the arrays below to answer each set of questions.

1.

a. How many rows of erasers are there? _____
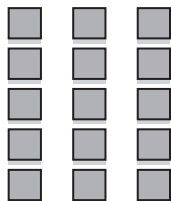
b. How many erasers are there in each row? _____

2.

a. What is the number of rows? _____

b. What is the number of objects in each row? _____

3.

a. There are 3 squares in each row. How many squares are in 5 rows? _____

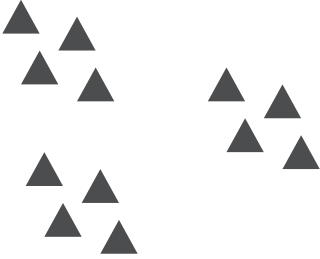b. Write a multiplication fact to describe the array. _____

4.

a. There are 6 rows of stars. How many stars are in each row? _____

b. Write a multiplication fact to describe the array. _____

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5. The triangles below show 3 groups of 4.

a. Redraw the triangles as an array that shows 3 rows of 4.

b. Compare the drawing to your array. How are they the same? How are they different?

6. Roger has a collection of stamps. He arranges the stamps into 5 rows of 4. Draw an array to represent Roger's stamps. Then write a multiplication sentence to describe the array.

7. Kimberly arranges her 18 markers in an array. Draw an array that Kimberly might make. Then write a multiplication sentence to match your array.

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